WHAT IS CLAIMED IS:

Claim 1. An imaging apparatus for imaging a specimen within the evanescent field present upon reflection of a beam of light at a TIR surface comprising;

a polarized light source emitting a polarized, extended beam of light;

a TIR structure having a TIR surface, the light from said polarized light source member being reflected only a single time by the TIR surface, the specimen being within the evanescent field associated with the total internal reflection at the TIR surface; and

a polarization-sensitive two-dimensional array detector, said detector detecting the light beam reflected from the TIR surface including the spatially distributed polarization change caused by the specimen.

Claim 2. Apparatus as in Claim 1 wherein said polarized light source member comprises a quasi-monochromatic light source of moderate bandwidth.

Claim 3. Apparatus as in Claim 1 wherein said polarized light source member comprises a laser emitting substantially coherent light, and further comprising an optical diffuser mechanically attached to a mechanical actuator, the light emitted from said laser passing through said diffuser, said diffuser being moved with respect to said laser by said actuator, the movement of said diffuser with respect to said laser creating fluctuations in the speckle pattern of light detected by said detector, said fluctuations being adapted to remove speckle effects from the light detected by said detector.

Claim 4. Apparatus as in Claim 1, wherein said polarized light source member comprises a beam forming system, said beam forming system causing the light emerging from said polarized light source member to be collimated.

Claim 5. Apparatus as in Claim 1, wherein said polarized light source comprises an optical polarizer.

Claim 6. Apparatus as in Claim 1, wherein said detector detects spatially distributed polarization change in the light beam.

Claim 7. Apparatus as in Claim 1 wherein said polarized light source member comprises an optical retarder, said retarder introducing an optical phase shift between two orthogonal components of light passing through said retarder.

Claim 8. Apparatus as in Claim 1, wherein said TIR structure comprises an optical prism.

Claim 9. Apparatus as in Claim 1, wherein said specimen comprises a two-dimensional array formed of multiple fields comprising biomolecular substances.

Claim 10. Apparatus as in Claim 1, wherein said polarization-sensitive, two-dimensional array detector comprises an optical polarizer.

Claim 11. Apparatus as in Claim 1, wherein said polarization-sensitive, two-dimensional array detector comprises a two-dimensional CCD array.

Claim 12. Apparatus as in Claim 1, wherein said polarization-sensitive, two-dimensional array detector comprises a two-dimensional photodiode array.

Claim 13 Apparatus as in Claim 1, further comprising a signal processing member, said signal processing member being connected to said polarization-sensitive, two-dimensional array detector, said signal processing member processing the signal from said polarization-sensitive, two-dimensional array detector to obtain a two-dimensional representation of the optical phase shifts occurring in the specimen.

Claim 14. Apparatus as in Claim 2 wherein said quasi-monochromatic light source of moderate bandwidth is a light-emitting diode (LED).

Claim 15. Apparatus as in Claim 2 wherein said quasi-monochromatic light source of moderate bandwidth is a superluminescent diode (SLD).

Claim 16. Apparatus as in Claim 2 wherein said quasi-monochromatic light source of moderate bandwidth has an optical bandwidth with a full width half maximum between 5 nm and 60 nm.

Claim 17. Apparatus as in Claim 2 wherein said quasi-monochromatic light source of moderate bandwidth comprises an incandescent source and an optical filter, the light emitted from said light source passing through said filter, said filter limiting the wavelengths of the light transmitted through said optical filter such as to constitute quasi-monochomatic light of moderate bandwidth.

Claim 18. Apparatus as in Claim 3, wherein said mechanical actuator is a motor rotating said optical diffuser.

Claim 19. Apparatus as in Claim 7, wherein said optical retarder is set up to be controllably rotated by a motor.

Claim 20. Apparatus as in Claim 7, wherein said optical retarder is set up to change its retardance according to an externally introduced physical parameter.

Claim 21. Apparatus as in Claim 8, wherein the light from said polarized light source member is directed to enter said prism along an axis perpendicular to one of the sides of said prism.

Claim 22. Apparatus as in Claim 8, wherein the light reflected from said TIR surface exits said prism along an axis perpendicular to one of the sides of said prism.

Claim 23. Apparatus as in Claim 9, wherein said biomolecular substances are proteins.

Claim 24. Apparatus as in Claim 9, wherein said biomolecular substances are peptides.

Claim 25. Apparatus as in Claim 9, wherein said biomolecular substances are polynucleotide sequences.

Claim 26. Apparatus as in Claim 10, wherein said polarizer is set up to be controllably rotated by a motor.

Claim 27. A method of imaging a chemical specimen array comprising;

passing an extended polarized light beam into a TIR structure for reflection at a TIR surface of the TIR structure and exiting after a single reflection at said TIR surface;

a specimen being in the evanescent field of the reflected light beam;

detecting the spatially distributed change in polarization state caused by the array; and

processing the spatially distributed change in polarization state information detected to provide an image of the specimen array.

Claim 28. The method of Claim 27 wherein said specimen array comprises a plurality of discrete specimen spots and said image is provided for each of said discrete specimen spots.

Claim 29. A method of characterizing a two-dimensionally distributed chemical specimen array in the evanescent field associated with total internal reflection of a beam comprising;

directing an extended beam of light of known polarization state at a total internal reflection surface, the beam undergoing a single total internal reflection at the total internal reflection surface; and

determining the spatially distributed change in the beam's polarization state caused by the chemical specimen array in the evanescent field.

Claim 30. The method of Claim 29 further comprising using the spatially distributed change in the beam's polarization state, determining two-dimensionally distributed presence or properties or both of constituents of the chemical specimen array.

Claim 31. The method of Claim 30 wherein the chemical specimen array is in a micro-titer plate comprising;

resolving the spatially distributed polarization changes in the light beam for matching positions in the micro-titer plate; and

analyzing the polarization changes to determine desired characteristics in each position.

Claim 32. The method of Claim 30 wherein the chemical specimen array is a series of discrete specimen spots ; and

the method comprises analyzing the polarization state changes to determine the binding characteristics of each discrete specimen spot in the array.

Claim 33. The method of Claim 29 wherein a chemical specimen array having no molecular tagging is placed with the evanescent field associated with the beam.

Claim 34. An imaging apparatus comprising;

a source of a polarized light beam; and

a TIR structure configured to receive the polarized light beam for a single reflection at a TIR surface thereof and for the reflected light beam to exit TIR structure.